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Anti-HIV using Nano Robots

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ABSTRACT

Nanorobots are nanodevices that will be used for the purpose of maintaining and protecting the human body against pathogens. Nano is one billionth of one centimeter. It is the application of different technologies primarily interested in the reduction of size.

The credential part of this paper gives the theoretical application of nanodevices in the treatment of AIDS. There is no technology for the treatment of AIDS. Some of the drugs of specific composition are given nowadays to the patients depending on the intensity of the disease which increase their lifetime to a few years only. To make the treatment more specific, we use the nanodevices that use nanosensors to sense the AIDS infected WBC's. In this method, we are using nanorobots to get back the HIV infected WBC's. By doing so, constant levels of WBC's are maintained in the blood stream. Thus, the AIDS patient is provided with an immune system so that he can defend himself from diseases.

In this paper, only a theoretical analysis is given and all the information provided is specifically organized by us. In India, more than 50 lakhs of people are infected by this dreaded disease and it constitutes 10% of the total infected. We are doing research on this paper and we hope that this theoretical approach can be made practical in the near future, so that the killer disease AIDS could also be made in control in the hands of Human with the emerging new technologies like NANOTECHONOLOGY which has a Bio-medical application.

1. INTRODUCTION

1.1. AIDS: Acquired Immuno deficiency Syndrome (AIDS), is a human viral disease that ravages the immune system, undermining the body's ability to defend itself from infection and disease. Caused by the human immunodeficiency virus (HIV), AIDS leaves an infected person vulnerable to opportunistic infections which can prove fatal. Our paper aims at the removal of the virus to from the RNA of the body using the nanorobots.

1.2. HIV: Human Immuno deficiency Virus:

The human immunodeficiency virus (HIV) principally attacks CD4 T-cells, a vital part of the human immune system. As a result, the body's ability to resist the opportunistic viral, bacterial, fungal, protozoal, and other infection is greatly weakened. Pneumonia is the leading cause of the death among people with HIV infection, and the incidence of certain types of cancers is also increased rapidly. Neurological complications and dramatic weight loss are the symptoms of end stage HIV disease. HIV can be transmitted

sexually,through contact with contaminated blood, tissue, or needles; and from mother to child during birth or breastfeeding.

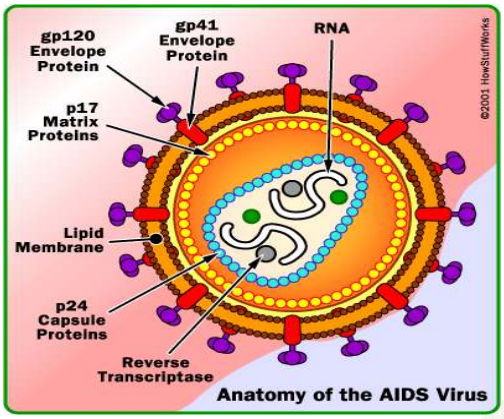


Fig 1. Anatomy of the AIDS virus

3. REASONS FOR APPLYING NANOTECH TO BIOLOGICAL SYSTEMS:

Most animal cells are 10,000 to 20,000 nanometers in diameter. This means that nanoscale devices can enter cells and the organelles inside them to interact with DNA and proteins. Tools developed through nanotechnology may be able to detect disease in a very small amount of cells or tissue and may allow tools for different tests to be situated together..In general, nanotechnology may offer a faster and more efficient means for us to do much of what we do now.

4. BIOMEDICAL APPLICATIONS OF NANOROBOTS:

The enormous potential in the biomedical capabilities of Nano-Robots and the imprecision and less side effects of medical treatments today make Nano-Robots very desirable**.** But today, we propose for Nanomedical robots, since they will have no difficulty in identifying the target site cells even at the very early stages which cannot be done in the traditional treatment and will ultimately be able to track them down and destroy them wherever they may be growing.

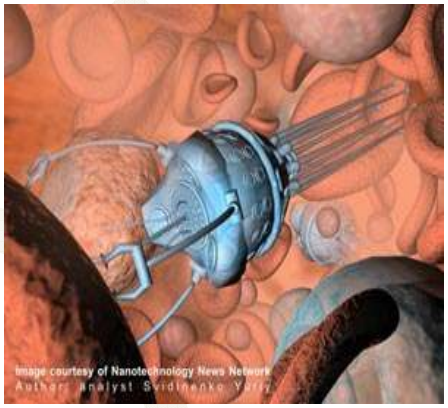
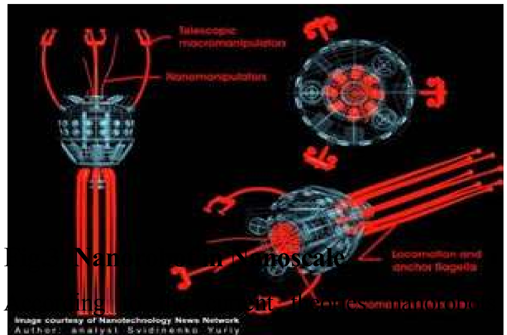


Fig.2 Nanorobot designed to perform cell surgery

4.1 WHAT IS A MEDICINAL NANOROBOT?

Nanorobots are theoretical microscopic devices measured on the scale of nanometers .When fully realized from the hypothetical stage, they would work at the atomic ,molecular and cellular level to perform tasks in both the medical and industrial fields.. Nanomedicine's nanorobots are so tiny that they can easily traverse the human body. Scientists report that the exterior of a nanorobot will likely be constructed of carbon atoms in a diamondoid structure because of its inert properties and strength. Glucose or natural body sugars and oxygen might be a source for propulsion, and it will have other biochemical or molecular parts depends on task.



[illegible] Nan[illegible]n Nanoscale

A[illegible]ing [illegible]ent theories nanorobo[illegible] will possess at least the rudimentary two-way communication, will respond to acoustic signals, and will be able to receive power or even re-programming instructions from an external source via sound waves. A network of special stationary nanorobots might be strategically positioned throughout the body, logging each active nanorobot as it passes, and then reporting those results, to keep track of all of the devices in the body. A doctor could not only monitor a patient's progress but change the instructions of the nanorobots in vivo to progress to another stage of healing. When this task is completed, the nanorobots would be flushed from the body.

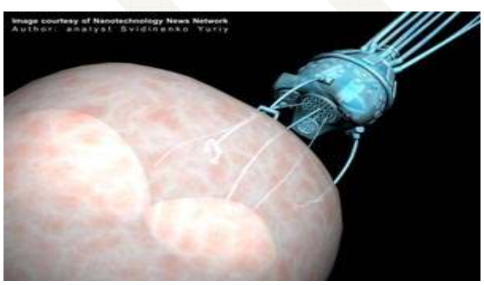


Fig. 4 Nanorobot performing operations on blood cells:

Nanorobotic phagocytes which are called microbivores could patrol in the bloodstream, seeking out and digesting unwanted pathogens including bacteria, viruses or fungi. Each nanorobot could completely destroy one pathogen in just 30 seconds - about 100 times faster than natural leukocytes or macrophages - releasing a harmless effluent of amino acids, mononucleotides, fatty acids and sugars. Related nanorobots could be programmed to recognize and digest cancer cells, or to clear circulatory obstructions within minutes in order to rescue the stroke patients from ischmenic damage. More sophisticated medical nanorobots will be able to intervene at the cellular level, performing surgery within the cells. Physician-controlled nanorobots could extract existing chromosomes from a diseased cell and then insert newly manufactured ones in their place, which is a process called the chromosome replacement therapy. This would allow a permanent cure of any pre-existing genetic disease, and permit cancerous cells to be reprogrammed to a healthy state

5. IMPLEMENTATION:

ANTI - HIV USING NANOTECHNOLOGY:

The immune system is a system within all vertebrates which in general terms, is comprised of two important cell types: the B-cell and the T-cell. The B-cell is responsible for the production of antibodies ,and the T-cell is responsible either for helping the B-cell to make antibodies, or for the killing of damaged or "different" cells within the body. The two main types of T-cells are the "helper"T-cell and the

cytotoxic T-cell. The T-helper population is further divided into those which help B-cells (Th2) and those which help Cytotoxic T-cells (Th1).

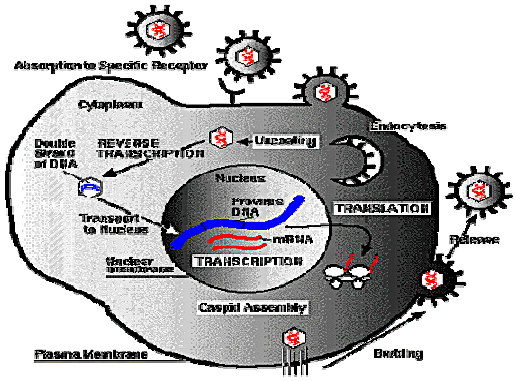


Fig 5. retrovirus replication

5.1 IMMUNE SYSTEM AND OPERATION OF HIV:

Whenever any foreign substance or agent enters our body, the immune system is activated. Both B- and T-cell members respond to the threat, which eventually results in the elimination of the substance or agent from our bodies. Normally, these actions are wonderfully protective of us. The effect of HIV on the immune system is the result of a gradual elimination of the Th1 and Th2 helper T-cell sub-population. Remember about the proteins, which envelope HIV. One of these proteins, named gp 120,"recognizes" a protein on helper T-cells named CD4, and physically associates with it. The CD4 protein is a normal part of a helper T-cell's membrane.

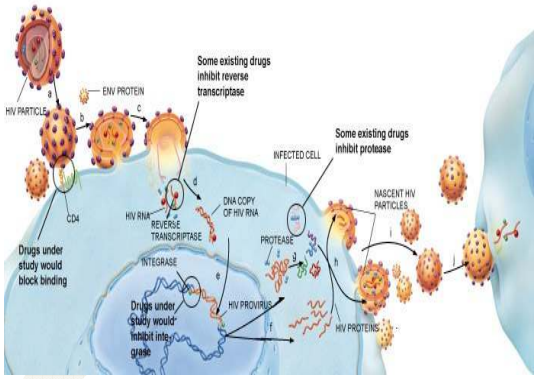


Fig 6. Interaction of HIV with CD4

As a consequence of the interaction with CD4 on helper T-cells, HIV specifically infects the very cells necessary to activate both B-cell and cytotoxic T-cell immune responses.. Consequently, the virus can multiply, and kill the helper T-cell in which it lives. The fight between the virus and the immune system for supremacy is continuous until the body eventually succumbs, apparently because of the inability to any-longer produce T-cells. This results in the complete inability of our body to ward-off even the weakest of the organisms. This acquired condition of immune deficiency is called, AIDS.

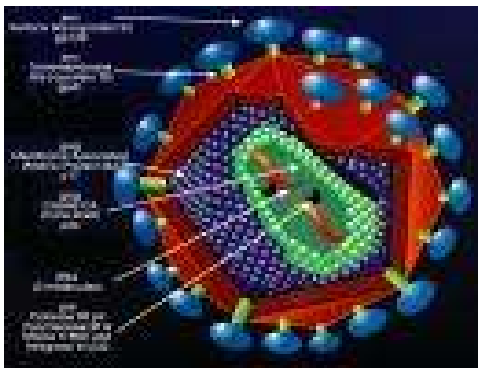


Fig.6 Structure of AIDS virus

5.2 METHODOLOGY:

AIDS by itself is not a killer disease. The cause of AIDS is the HIV virus that is capable of destroying the immune system. Thereby the host system is vulnerable to small diseases which will turn into a fatal one but actually it is not a fatal disease. The HIV virus attack the WBC's by converting them into the HIV. Thereby the immune system will fail causing the death of the patient. Our idea is to convert the AIDS affected WBC's back into the original form of the WBC by using a Nanorobot, thereby the patient is made to have a constant amount of immune system. Nanorobot performs the inverse process of the HIV.

5.3 CONVERSION RATE:

The HIV convert the WBC in a faster manner .So the conversion by the A-HIV Nanorobot should also be very much faster than that of the HIV, so that a constant level of WBC's are maintained in the blood stream. So ,an AIDS patient can defend himself from various diseases .The conversion rate should be at least five times greater than that of the HIV conversion rate.

5.4 BASIC EQUATION: The basic equation for the conversion of the HIV infected WBC's back to its original form is given below.

Fig.7 Basic equation

6. CREATION OF NANO DEVICES:

The creation of the nano devices can be done using TOP DOWN & BOTTOM UP APPROACH.

6.1. THE CHALLENGES FACED BY NANOROBOTS:

While designing nanorobots in nanoscale dimensions there should be a better understanding of how matter behaves on this small scale. So, the behaviour of the nanorobots must be taken care to have no side effects. Other challenges are Nanostructures can be so small that the body may clear them too rapidly for them to be effective in detection or imaging. Larger nanoparticles may accumulate in vital organs, creating a toxicity problem. So we should attempt to create devices the body will accept.

6.2 DESIGN OF NANOROBOTS:

While designing it the main factors that are to be considered are given below:

6.2.1 SIZE:

Nanorobots will typically be 0.5 to 3 microns large with 1-100 nm parts. Three microns is the upper limit

of any nanorobot because nanorobots of larger size will block capillary flow.

6.2.2 STRUCTURE:

Interior: It will be a closed, vacuum environment into which liquids from the outside cannot normally enter unless it is needed for chemical analysis.

Exterior: It will be subjected to various chemical liquids in our bodies.

6.2.3. ABILITY TO DEFEND FROM IMMUNE SYSTEM:

Immune system response is primarily a reaction to a "foreign" surface.. Passive diamond exteriors may turn out to be ideal. Allergic and shock reactions are avoided.

6.2.4 ACQUIRING POWER:

It could metabolize local glucose and oxygen for energy. Another possibility is externally supplied acoustic power, which is probably most appropriate in a clinical setting.

6.2.5 COMMUNICATON:

Having nanorobots inside the body it is very essential to know the actions done by it.. One of the simplest ways to send broadcast-type messages into the body, to be received by nanorobots, is acoustic messaging.

6.2.6 TRACKING:

A navigational network may be installed in the body, with station and Physical positions can be reported continuously using an in vivo communications network.

6.2.7 STRUCTURE OF NANOROBOT:

The nanorobot consists of three main parts like the DNA sensor, CPU, RNA converter and the power system. The purpose of DNA sensor is to identify the HIV infected cell. The RNA converter is used to change the RNA of the HIV. The CPU controls all the activities .The power system provides the necessary energy for the working of the nanorobot.

7. COMPONENTS OF NANO ROBOTS:

7.1 DNA SENSOR:

The DNA sensor is an cantilever type.In one arm the actual sample is placed and in the second arm the sample from the WBC is placed. Even if the samples differ by a single base ,it can be identified . Carbon nanotube network field-effect transistors (NTNFETs) that function as selective detectors of DNA immobilization and hybridization.

7.2 POWER SYSTEM:

The nanorobot uses the glucose molecules present in the human body as the power source. The conversion of this glucose molecule into the energy is accomplished by the energy converter, which is an important part of the nanorobot.

8. REQUIREMENTS OF THE NANOROBOT:

1. It should be very small so that the blood capillary flow is not affected and should not be affected by wbc.

2. It should be capable of sensing the HIV infected WBC only and its action is restricted to the infected WBC only.

3. It should make its operations in the RNA to convert back to the original DNA of the WBC by suitably changing the bases like the adenine, guanine.

4. It should convert the infected WBC into the original WBC in a very faster manner and made of cheaper rates.

9. ADVANTAGES:

1. More than million people in this world are affected by this dreaded disease. Currently there is no permanent vaccine or medicine is available to cure the disease. The currently available drugs can increase the patient's life to a few years only, so the invention of this nanorobot will make the patients to get rid of the disease. and has no side affects.

2. As the nanorobot do not generate any harmful activities there is no side effect. It operates at specific site only.

10. DISADVANTAGES:

1. The nanorobot should be very accurate, otherwise harmful effects may occur.

2. The initial design cost is very high.

11. CONCLUSION:

The paper is just a theoretical justification. But the recent advancement in the field of nanotechnology gives the hope of the effective use of this technology in medical field. This paper starts by giving an introduction to nanorobots and its importance as recognized by various other technocrats. This is the beginning of nanoera and we could expect further improvements such as a medicine to AIDS using nanotechnology .

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